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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/788,365	02/21/2001	Tuqiang Ni	015290-517	3359

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EXAMINER  
ZERVIGON, RUDY

ART UNIT PAPER NUMBER  
1763

DATE MAILED: 01/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/788,365

Applicant(s)

NI ET AL.

Examiner

Rudy Zervigon

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 24 October 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 25 and 28-45 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 25 and 28-45 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 25, 29, 33, 34, 37, 38, 42, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii (USPat. 5,685,942) in view of Li et al (USPat. 5,772,771).

Ishii teaches a dielectric gas injector (85, Figure 4) supplying process gas into a plasma processing chamber (82; column 7, line 63 - column 8, line 22) wherein a semiconductor substrate ("W") is subject to plasma processing (column 3, lines 28-50). The gas injector further comprises a gas injector body (85, Figure 4) sized to extend through a chamber wall (83) of the processing chamber. As shown in Figure 4, the axial planar distal end surface (surface containing ports 87) of the gas injector body is exposed within the processing chamber. Figure 4 shows that the gas injector body includes a plurality of gas outlets (87) adapted to supply process gas into the processing chamber.

Figure 4 shows that the gas outlets of the gas injector body (85, Figure 4) are located at an axial end surface (surface containing ports 87) of the gas injector body. The gas outlets further including wherein the gas outlets are located are located in the axial distal end surface of the gas injector body.

Ishii further teaches that the gas injector includes a planar axial end surface (surface containing ports 87; Figure 4) that is flush with an interior surface of a dielectric window (83; "insulating

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material"; column 8, line 7) forming a chamber wall. Ishii also teaches a surface (flange portion of 85, Figure 4) adapted to overlies an outer surface of the chamber wall.

Ishii does not teach gas outlets further including a plurality of angled gas outlets extending at an acute angle to the axial direction.

Li teaches a gas injector (Figure 1A) supplying process gas into a plasma processing chamber (18; column 3, lines 20-47). The gas injector further comprises a gas injector body (56a/64, Figure 1) sized to extend through a chamber wall (25) of the processing chamber.

As shown in Figure 1/1A, the distal end (64) of the gas injector body is exposed within the processing chamber. Figure 1A shows that the gas injector body includes three angled gas outlets (64) adapted to supply process gas into the processing chamber. Figures 1 and 1A shows that the gas outlets (64, Figure 1, 1A) of the gas injector body (56, Figure 1) are located at an axial end surface (56) of the gas injector body.

Specifically, Li teaches a plurality (3) of angled gas outlets (Figure 1A) extending at an acute angle to the axial direction.

Li does not teach 8 angled gas outlets as claimed by claim 43. Li does not teach the acute angle of the gas injector as being between 10° to 70°.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Ishii to change the angle of a plurality of his gas outlets such that they extend at an acute angle between 10° to 70° to the axial direction and add additional gas outlets as taught by Li.

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Motivation for Ishii to change the angle of a plurality of his gas outlets such that they extend at an acute angle between to 10° to 70° to the axial direction and add additional gas outlets as taught by Li is to process larger area substrates (column 5, lines 19-28). Further, it is well established that the duplication of parts is obvious (In re Harza , 274 F.2d 669, 124 USPQ 378 (CCPA 1960) MPEP 2144.04).

3. Claims 28, 30-32, 35, 36, 39, 40, 43, and 44 are rejected under 35 U.S.C. 103(a) as being obvious over Ishii (USPat. 5,685,942) and Li et al (USPat. 5,772,771), in view of McMillin et al (USPat. 6,013,155).

The applied reference to McMillin et al (USPat. 6,013,155) has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). For applications filed on or after November 29, 1999, this rejection might also be overcome by showing that the subject matter of the reference and the claimed invention were, at the time the invention was

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made, owned by the same person or subject to an obligation of assignment to the same person.

See MPEP § 706.02(l)(1) and § 706.02(l)(2).

Ishii and Li are discussed above. However, Ishii and Li do not teach a first O-ring seal in a surface of the flange for sealing against the outer surface of the chamber wall. Ishii and Li do not teach a second O-ring seal on an outer surface of the gas injector body. Ishii and Li further do not teach a gas injector for supplying process gas at sonic velocity.

McMillin teaches a gas injector (250, Figure 19b) supplying process gas, at sonic velocity (column 7, lines 55-61), into a plasma processing chamber (140, Figure 2a). The gas injector further comprises a gas injector body (250, Figure 19b) sized to extend through a chamber wall (155) of the processing chamber. As shown in figure 19b, the distal end (220) of the of the gas injector body is exposed within the processing chamber. Figure 19b shows that the gas injector body includes a plurality of gas outlets (252, 254, 258) adapted to supply process gas into the process chamber. Figure 19b shows that a gas outlet (258) of the gas injector body is located at an axial end surface (258) of the gas injector body. McMillin also teaches a center gas outlet (258) extending in the axial direction and a plurality of angled gas outlets (254) extending at an acute angle to the axial direction. McMillin also teaches a closed distal end surface (surface housing outlet 258, Figure 19b) including gas outlets (254) that inject process gas at an acute angle relative to a plane parallel to the distal end surface. McMillin also teaches at least one O-ring seal (157; column 16, lines 11-30) providing a vacuum seal between the gas injector and the chamber wall.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add an O-ring seal in a surface of the flange for sealing against the outer surface of the

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chamber wall and to add a second O-ring seal on an outer surface of Ishii's gas injector body, and to flow the process gas at sonic velocity as taught by McMillin.

Motivation to add an O-ring seal in a surface of the flange for sealing against the outer surface of the chamber wall and to add a second O-ring seal on an outer surface of Ishii's gas injector body, and to flow the process gas at sonic velocity as taught by McMillin is to provide for vacuum integrity as taught by McMillin (column 16, lines 11-25).

Motivation for Ishii to optimize the flow the process gas to sonic velocity as taught by McMillin is for preventing plasma penetration of the injectors as taught by McMillin (column 7, lines 55-60). Further, it would be obvious to those of ordinary skill in the art to optimize the operation of the claimed invention (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); Merck & Co. Inc. v. Biocraft Laboratories Inc., 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); In re Kulling, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

4. Claims 28, 30-32, 35, 36, 39, 40, 43, and 44 are rejected under 35 U.S.C. 103(a) as being obvious over Ishii (USPat. 5,685,942) and Li et al (USPat. 5,772,771), in view of Rossman et al (USPat. 6,077,357).

Ishii and Li are discussed above. However, Ishii and Li do not teach a first O-ring seal in a surface of the flange for sealing against the outer surface of the chamber wall. Ishii and Li do not teach a second O-ring seal on an outer surface of the gas injector body. Ishii and Li further do not teach a gas injector for supplying process gas at sonic velocity.

Rossman teaches a gas injection nozzle (302; Figure 14) including a first O-ring seal (326) in a surface of the flange for sealing against the outer surface of the chamber wall (314). Rossman

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further teaches a second O-ring seal (322, 324; Figure 14) on an outer surface of the gas injector body.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add an O-ring seal in a surface of the flange for sealing against the outer surface of the chamber wall and to add a second O-ring seal on an outer surface of Ishii's gas injector body, and to flow the process gas at sonic velocity as taught by Rossman.

Motivation to add an O-ring seal in a surface of the flange for sealing against the outer surface of the chamber wall and to add a second O-ring seal on an outer surface of Ishii's gas injector body, and to flow the process gas at sonic velocity as taught by Rossman is to provide for vacuum integrity as taught by Rossman (column 17, lines 54-56).

Motivation for Ishii to optimize the flow the process gas to sonic velocity is for increasing processing throughput. Further, it would be obvious to those of ordinary skill in the art to optimize the operation of the claimed invention (*In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

5. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii (USPat. 5,685,942) and Li et al (USPat. 5,772,771) in view of Kawase et al (USPat. 5,734,143). Ishii and Li are discussed above. Ishii further teach his gas injector (85; Figure 4) including a uniform diameter central bore (88a) extending axially from an upper axial end face (top surface 85) of the



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gas injector body, the central bore being defined by a cylindrial sidewall and a flat endwall (bottom surface 85).

Ishii and Li do not teach that the inlets of the gas outlets (87) are located on the flat endwall.

Kawase teaches a plasma torch head nozzle (Figure 2; column 5, line 66 – column 3, line 31).

Inclusive, Kawase teaches gas injector (Figure 2) including a uniform diameter central bore (along axis 70) extending axially from an upper axial end face (top of 11) of the gas injector body, the central bore being defined by a cylindrial sidewall and a flat endwall (bottom of 11) where the inlets of the gas outlets (10) are located on the flat endwall.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace Ishii's injector body with Kawase's injector body.

Motivation to replace Ishii's injector body with Kawase's injector body is to form stable plasmas as taught by Kawase (column 2, lines 10-15).

#### ***Response to Arguments***

6. Applicant's arguments filed January 8, 2004 have been fully considered but they are not persuasive.

7. Applicant has stated in the response that "McMillin is assigned to Lam Research Corporation and the inventors of the present application were under an obligation to assign all rights in the presently claimed invention to Lam Research Corporation at the time the claimed invention was made.". However, it is clearly stated above, that to overcome a 103(a) rejection with applied 102(e) art Applicant must state "the subject matter of the reference and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.". The Examiner believes that Applicant's statement

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and the required statement are not equivalent. The Examiner requests that Applicant more accurately apply the requisite statute.

*Conclusion*

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

*Rudy Zervigon*  
1/12/11